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OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

March 20 through March 26, 1998

Summary 98-12

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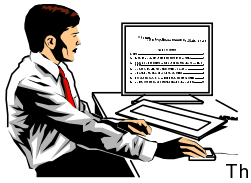

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EVENTS

1. UNREVIEWED SAFETY QUESTION ON LOSS OF POSITIVE REACTIVITY CONTROL

On March 19, 1998, at the Los Alamos Critical Experiments Facility a facility manager reported that a positive unreviewed safety question existed for an event that resulted in the scram of the Planet assembly. On February 26, 1998, during a subcritical operation, an operator scrammed the assembly when she lost joystick control of positive reactivity insertion into the assembly. The scram safely shut the assembly down as designed. Facility engineers evaluated the adequacy of the safety analysis report and determined that the report failed to address a joystick failure as an accident initiator. Although there was no impact to the health and safety of personnel, the equipment, or the environment, the failure to analyze all accident initiators reduced the margin of safety as defined in the facility technical specifications requirements document for the maximum positive reactivity insertion rates. (ORPS Report ALO-LA-LANL-TA18-1998-0001)

The Planet is a general-purpose assembly used for criticality experiments. At the time of this event, the fuel in the assembly was uranium-235 laminated foils that were alternately hand-stacked with layers of Plexiglas™ that is used as a neutron moderator and reflector. The assembly uses two separate foil stacks, one located above the other. The operator uses a joystick on a control panel to remotely move the two stacks together. This adds positive reactivity to the assembly by increasing the interaction between the neutrons and the fuel in the two stacks and allows the assembly to approach a critical mass. The addition of positive reactivity is controlled by the number of foils and Plexiglas™ layers in the stack and the speed that a stepping motor moves the two stacks closer together. Once the two stacks are within a pre-set distance from each other, a central processing unit decreases the stepping-motor speed from full speed to slow speed.

On February 26, the operator was closing the two stacks in slow speed when the stepping motor unexpectedly switched to full speed. The joystick control quit responding to the operator, and the scram button on the joystick did not respond. The operator pressed the panel-mounted scram switch, and the two stacks separated back to their starting positions as designed. The activation of the scram placed the assembly in a safe configuration. The configuration of the assembly was such that it would have remained subcritical even at full closure of the two stacks. Facility personnel conducted an assessment to ensure that the assembly was not damaged.

Engineers troubleshot the control circuitry and discovered problems with the software and flaws in the communication between the joystick controls and the central processing unit. They determined that when the joystick interface did not respond, a subroutine returned an ASCII (American Standard Code for Information Interchange) character "?" to the main program for the potentiometer settings that controlled the stepping motor speed. The main program was never developed to deal with a question mark and translated this value to the number equivalent of an ASCII "?" (the number 63). The number 63 corresponded to a large negative position (beyond closure of the stacks) that caused the stepping motor to drive in at full speed when it was selected for movement.

The facility manager upgraded the original notification report from an off-normal to an unusual occurrence. Upgrading the report was based on the positive unreviewed safety question for the Planet assembly. Engineers found the unreviewed safety question determination to be positive for the following reasons.

- The probability of an accident, as defined by the safety analysis report, was increased by the loss of control of positive reactivity insertion rate.
- Engineers discovered a new mechanism that could increase the probability of a malfunction of equipment important to safety, as defined by the safety analysis report. The new mechanism could allow for a positive reactivity insertion rate greater than 5 cents/second.
- The safety analysis report failed to address the failure of the joystick as an accident initiator.
- The margin of safety was reduced from that defined in the technical specification requirement document. The technical specification requirement allows a maximum positive reactivity insertion rate of 5 cents/second. As the stacks are brought together, the slower insertion rate ensures that this requirement is met.

The facility manager presented the positive unreviewed safety question to the Los Alamos Area Office. Operations with the Planet assembly have been suspended since the incident on February 26. Engineers also reviewed other critical assemblies that use a joystick controller for similar deficiencies and found none.

This event illustrates the importance of performing a thorough review of all accident initiators as part of the facility safety analysis report. This event also points out the importance of verification and validation of software programs that are used with equipment important to safety. These reviews are necessary to ensure that the facility is not operated or placed in an unsafe condition. DOE 5480.23, *Nuclear Safety Analysis Reports*, states that it is DOE policy that nuclear facilities and operations be analyzed to (1) identify all hazards and potential accidents associated with the facility and the process systems, components, equipment, or structures and (2) establish design and operational means to mitigate these hazards and potential accidents. The results of these analyses are to be documented in safety analysis reports. DOE 5480.21, *Unreviewed Safety Questions*, provides the following three criteria for identifying unreviewed safety questions: (1) if the probability of occurrence or the consequences of an accident that is analyzed in the safety analysis report are changed; (2) if the possibility of an accident of a different type than analyzed in the report may be created; and (3) if the margin of safety, as defined in any technical specification, is reduced.

KEYWORDS: critical mass, reactivity, safety analysis report, unreviewed safety question

FUNCTIONAL AREAS: Licensing/Compliance, Nuclear/Criticality Safety

2. IMPROPERLY STORED SOURCE RESULTS IN NEUTRON EXPOSURE

On March 19, 1998, at the Idaho National Environmental Engineering Laboratory Test Area North Operations Facility, a facility manager reported that an employee received an unexpected radiological exposure to neutrons from an improperly stored americium-beryllium source.

Radiological personnel determined the employee had received a neutron exposure during a quarterly analysis of his thermoluminescent dosimeter. Further investigation by radiological personnel revealed that the americium-beryllium source was stored on a top shelf of a cabinet that was below the employee's office for at least 6 years. They also determined that procedures required the source to be stored in an appropriate container. Radiological engineering personnel should have identified the appropriate storage container as a borated polyethylene container; however, no one consulted them to identify the correct storage container. The facility manager ordered radiological personnel to restrict access to the office above the storage area and to an unstaffed area adjacent to the source storage area until radiological health services personnel complete a neutron energy spectrum analysis. Improper storage of a sealed source led to a worker exposure and may have resulted in additional undetected exposures. (ORPS Report ID--LITC-TANO-1998-0005)

Investigators determined that radiological personnel use a computer to flag discrepancies that are above pre-determined limits when they process the thermoluminescent dosimeters. Radiological personnel then review all dosimeter results. Investigators determined that, although the dosimeter readings were not above any limits, the radiological worker questioned them because of the large difference between the ratio of gamma and beta luminous elements. Because the difference was so large, she realized the employee must have been exposed to neutrons. She reviewed the employee's dosimeter data from two previous quarters and determined that the worker had been exposed to neutrons over the last several quarters. Investigators also determined that radiological personnel had stored the source in the cabinet inside its original shipping container and transferred it from the shipping container to a lead shielded container sometime last year. Radiological personnel routinely performed cabinet surveys and determined that they were less than the 5 mrem/hour procedural limit, so they believed that the source was properly stored.

The facility manager directed radiological health services to measure the office using a mist-calibrated, rotating neutron spectrometer to determine the exposure rates more accurately. Radiological personnel will leave the source in its current location until these measurements are completed and will then move it to a remote storage area. The facility manager also directed radiological health services to (1) determine the employee's actual exposure, using a tissue equivalent proportional counter; and (2) determine whether any one else was exposed to the source.

OEAF engineers reviewed the Weekly Summary and the ORPS database and found the following similar occurrences involving radiological storage areas.

- Weekly Summary 96-08 reported that a health physics technician at Argonne National Laboratory — East detected an elevated background radiation level along the northwest wall of a laboratory. The laboratory is used as an office and is not posted as a controlled area; therefore, personnel were not required to wear dosimetry. The technician determined that the radiation was coming from three 5-gallon metal pails and one 55-gallon metal drum of uncharacterized waste that were stored in an adjacent room. Investigators determined that unmonitored radiation levels were introduced in an office area where personnel received unmonitored radiation exposures. (ORPS Report CH-AA-ANLE-ANLEER-1996-0002)

- On March 22, 1991, at the Rocky Flats Environmental Technology Site Plutonium Processing and Handling Facility, a facility manager reported that an unreviewed safety question existed for storage of two plutonium-beryllium sources. Facility personnel determined that the sources would not maintain their integrity during a

fire because of their age and that the radiological consequences of an assumed fire would exceed those analyzed in the final safety analysis report. Investigators determined that, although the sources were registered and properly stored, no one evaluated the impact of the storage location with regard to the postulated accidents in the final safety analysis report. Corrective actions included revising procedures to evaluate source storage areas and to ensure the final safety analysis limits are not exceeded.

Americium-beryllium sources are typically used in content analysis devices. The source provides thermal neutron activation to determine the content of certain substances in a sample. Any material that the source beam contacts absorbs neutrons and becomes a short-lived radioactive source. The source content can range from 300 to 2000 millicuries. Content analysis devices may or may not contain source shielding mechanisms. They are used in three main applications: (1) well-logging, (2) general content analysis, and (3) explosive detection systems.

These events emphasize the importance of strict accountability of radioactive sources and demonstrate the need for a strong radioactive source control program. Personnel responsible for radioactive source control at DOE facilities should ensure their source control program includes the following elements from DOE N 441.1 through DOE N 441.3.

- administrative procedures for the control of accountable sealed radioactive sources
- labels on all accountable sources, or their storage containers or devices, with the standard radiation warning trefoil and the words, "Caution, Radioactive Material"
- an individual designated to maintain control of assigned accountable sources who is trained as a radiological worker in accordance with 10 CFR 835.902 and instructed on site-specific source control procedures
- periodic inventory of each accountable source at intervals not to exceed 6 months (The inventory should verify (1) physical location of each source, (2) adequacy of postings and labels, and (3) adequacy of storage locations, containers, and devices.)
- integrity test of each source with an activity exceeding 0.005 µCi upon receipt, when damage is suspected, and at intervals not to exceed 6 months

Personnel working at DOE facilities should have a continually questioning attitude toward safety issues. Each individual is ultimately responsible for complying with rules to ensure personal safety. Facility managers should communicate a sound policy stressing that safety is of prime importance and that all personnel must exhibit an individual commitment to excellence and professionalism. Personnel in charge of storing radioactive sources should review the following guidance and ensure that sources are stored in physical locations that prevent personnel exposure.

- DOE/EH-256T, *Radiological Control Manual,* requires control and accountability of sealed radioactive sources. It states: “Each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radiation and radioactivity.” The manual sets forth DOE guidance on the proper course of action in the area of radiological control, including work preparation; work controls; monitoring and surveys; and

training and qualifications. Section 123, "Worker Responsibilities," states that trained personnel should recognize that their actions directly affect contamination control, personnel radiation exposure, and the overall radiological environment associated with their work. The majority of pertinent radiological protection requirements have become codified through promulgation of 10 CFR 835, *Occupational Radiation Protection*. However, 10 CFR 835 currently does not address sealed radioactive source accountability; source accountability will be addressed in a pending revision. Facility managers should refer to DOE N 441.1, *Radiological Protection for DOE Activities*, for information on the control and accountability of sealed radioactive sources. The administrative lifespan of DOE N 441.1 was from September 30, 1995, to September 30, 1996, but was extended for 1 year by DOE N 441.2 and will be extended an additional year by DOE N 441.3.

- DOE Implementation Guide, G-N 5400.9/M1-Rev.1, *Sealed Radioactive Source Accountability and Control*, provides guidance for establishing and operating a sealed source accountability and control program. Specific guidance includes organization and responsibilities, receipt, labeling and storage, inventory, integrity testing, and handling and disposal.

Links to DOE radiation protection documents can be found at URL http://tis-nt.eh.doe.gov/wpphm /regs/regs.html.

KEYWORDS: sealed source, accountability, radiation protection

FUNCTIONAL AREAS: Radiation Protection

3. VIOLATION OF SAFE WORK PLAN

On March 10, 1998, at the Fernald Environmental Management Project, project engineers discovered that a demolition subcontractor general superintendent violated a safe work plan when he did not make all of the required critical cuts during the demolition of ducts and supporting structures for a boiler plant demolition project. The two 5-foot by 5-foot by 50-foot long ducts were formerly used to carry products of combustion from the boiler house to electrostatic precipitators. The project engineers notified the assistant emergency duty officer of the safe work plan violations, immediately suspended all activities on the demolition project, and limited personnel access to the immediate area. Investigators determined that on March 9, 1998, the superintendent made only 4 of the 16 critical cuts specified in the work plan. He also cut all base bolts, although the work plan specified that the front leg base bolts were to be left intact. Subcontractor demolition workers attached steel cables to the structure and a trackhoe to try to pull the structures down as specified in the work plan. The trackhoe operator made three unsuccessful attempts to pull the structure down before the subcontractor secured operations for the day. There was no impact to the health and safety of personnel, but if the structure had been pulled down, it could have fallen in the wrong direction and injured personnel or damaged equipment. (ORPS Report OH-FN-FDF-FEMP-1998-0012)

Investigators determined that the demolition subcontractor and Fluor Daniel Fernald engineers developed the work plan and approved it. They also determined that the work plan called for the subcontractor to cut the structural steel at 16 places and to cut the rear leg base bolts. Engineers specified the cuts in the structural steel so that the structures would fall to the north, reducing the possibility of injury to demolition workers when the ducts were pulled down. The superintendent

told investigators that he based his decision to deviate from the safe work plan on his belief that the plan was based on riveted structural steel members. However, the members were actually bolted. Because he also believed that bolted structural steel connections were weaker than riveted connections, the superintendent thought that the relative weakness of the bolted connections made most of the cuts to the structural steel unnecessary. Investigators determined that the safe work plan did not specify what type of connectors were used. Facility managers limited access to the area while project engineers developed a recovery plan to safely complete demolition of the ductwork.

NFS has reported on similar procedure violation occurrences in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-14 reported that decontamination and decommissioning workers at the Hanford N-Reactor cut through a conduit into an energized 220-volt cable. When the workers cut the conduit and wire, they observed arcing and sparking. Workers bypassed hold-points required by the procedure, and the assigned electrician did not conduct a zero energy check. Failure to follow procedures created the potential for injury and equipment damage. (ORPS Report RL--BHI-NREACTOR-1997-0006)

- Weekly Summary 96-47 reported that facility managers at the Savannah River Site issued a stand-down order to a subcontractor for violating site safety procedures. The subcontractor electrician did not wear gloves designed for use on low-voltage circuits when he conducted voltage checks on a known energized circuit and failed to remove metallic jewelry while performing the task. (ORPS Report SR--WSRC-CSWE-1996-0010)

- Weekly Summary 96-40 reported that operators at the Portsmouth Gaseous Diffusion Plant violated a procedure and used a cylinder stacker in a manner that caused an unreviewed safety question. The procedure required the operators to move cylinders using a crane, but the crane was out of service. The operators used a cylinder stacker instead. Engineers determined that operating the stacker near the uranium hexafluoride cylinders represented an unanalyzed hazard and could have resulted in a release of up to 20,000 pounds of toxic and radiological material if a cylinder had been ruptured. (ORPS Report USEC--MMUS-PTSGENPLT-1996-0065)

OEAF engineers searched the ORPS database for occurrences resulting from procedure violations and found 1,633 occurrences. Figure 3-1 shows the distribution of root causes for procedure violation occurrences. A review of these occurrences shows that managers reported the root cause of 54 percent of these occurrences as personnel error. Approximately 63 percent of the personnel error problems resulted from procedure not used or used incorrectly and 30 percent resulted from inattention to detail.

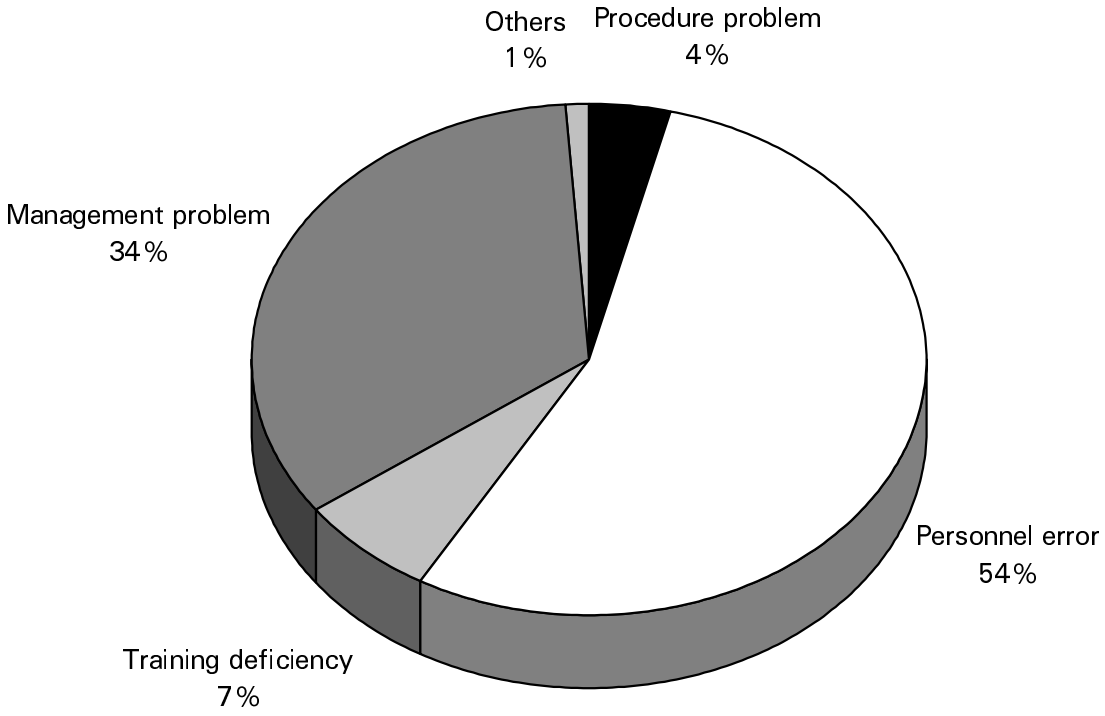

Figure 3-1. Root Cause Distribution for Procedure Violation Occurrences[1]

This event underscores the importance of following work plan steps and conducting the work plan according to the work requirements. Failure to do so could result in injury or a fatality. DOE facility managers should ensure that subcontractors understand the importance of following work plans and safety rules. If conditions found are not as expected, work should be stopped immediately and, if necessary, changes should be made to the work plan. These events also underscore the importance of writing a good work plan. Discrepancies between expected conditions and as-found conditions can result in confusion and increase the potential for errors in work plan execution.

DOE-STD 1029-92, *Writers Guide For Technical Procedures*, provides guidance to assist procedure writers across the DOE complex in producing accurate, complete, and usable technical procedures that promote safe and efficient operations. This guidance can also be applied to other technical documents such as work plans. Section 2.3, “Facility Configuration,” requires walk-downs, simulations, modeling, or desk-top reviews to ensure procedures are technically accurate and adequate.

KEYWORDS: demolition, procedures, work planning

FUNCTIONAL AREAS: Procedures, Work Planning

[1] OEAF engineers searched the ORPS database using the graphical user interface for reports with a nature of occurrence of 01F, violation/inadequate procedures, and a direct cause of 03B, procedure not used or used incorrectly.

4. SPARKS FROM PIPE HEAT-TRACING CAUSE INSULATION FIRE

On March 18, 1998, at the Los Alamos Health Research Laboratory, insulation around a chilled water pipe caught fire when an electrical short occurred in the pipe heat-tracing while an insulator was installing insulation around the pipe. Sparks from the heat-trace ignited the adjacent insulation material. The insulator immediately left the area and notified a facility coordinator who de-energized the heat-trace circuit. The fire self-extinguished after the power was removed from the circuit. Damage was limited to the burned insulation material and heat-tracing. This event is significant because investigators determined the heat-trace was not locked out, the insulator was not authorized to perform the work, and there was a delay in notifying emergency response personnel. (ORPS Report ALO-LA-LANL-HRL-1998-0002)

The insulator was reinstalling insulation around the chilled water pipe in a heating and air ventilation system located on a building roof following its removal to repair a leak in the pipe. There was an inch of water on the roof underneath the heating and air ventilation cabinet where the insulator was working, and the heat-trace was not locked out. As he reached in to wrap a pre-cut section of insulation around the pipe and heat-trace, the heat-trace sparked and ignited the insulation. The insulator immediately descended a permanently mounted ladder to the ground and ran 30 yards to find and notify the facility coordinator. When they returned to the scene, they saw sparks and 8- to 10-inch-high flames inside the smoke-filled cabinet. The facility coordinator went to an electrical panel to de-energize the heat-tracing, but was confused by the hand-written labels in the panel and opened the wrong circuit breaker. When he went back to check the status of the fire, he saw it had not been extinguished. He returned to the panel; inspected the labels more closely; and opened the correct breaker, extinguishing the fire. The facility coordinator then notified the building manager, the Environment, Safety, and Health team leader, and the project manager.

Investigators determined that the insulator and facility coordinator did not immediately make the appropriate emergency notifications for a fire. Emergency Management and Response personnel and the Laboratory fire inspector were not notified for at least 2 hours. Although the fire self-extinguished after the heat-trace was de-energized, firefighters were not there to ensure that the insulation was not smoldering or would not re-flash. General employee training provides instruction on emergency notifications, and telephones in the facility display emergency numbers, including 911. Investigators also learned that the insulator did not sign the log book for that day, and therefore was not authorized to perform the work. Because the insulator was working alone, he could have been injured or not accounted for in an emergency. Investigators have not determined if the insulator damaged the heat-trace or the heat-trace had deteriorated, but they believe that the spark occurred when the metallic backing on the insulation came in contact with the energized conductors. Investigators are still determining whether the heat-tracing circuit should have been de-energized and controlled by a lockout/tagout while the work was being performed.

NFS reported in Weekly Summary 97-44 that a plant maintenance worker at the Hanford Site received a slight electrical shock from a heat-traced line while excavating a potable water line. While removing dirt from around a standpipe, the worker wedged a shovel under the pipe, rocked it to free the surrounding earth, and accidentally cut the heat-trace. The worker was shocked because he came in contact with the metal standpipe when the shovel cut the heat-tracing. The worker did not expect to be near energized electrical lines, so he did not wear protective clothing. Investigators determined that the worker knew the heat-tracing was present on the line. However,

personnel did not lock or tag out the line because the worker was not expected to contact it. (ORPS Report RL--PHMC-KBASINS-1997-0023)

The following reports from ORPS illustrate the need to exercise care when working around electrical heat-tracing because it can easily be damaged or can deteriorate with age.

- On June 23, 1997, a pipefitter at Rocky Flats caused a spark when he nicked an energized 208-volt heat-trace wire with his knife while removing insulation from a water line. The heat-tracing was not identified on system drawings. (ORPS Report RFO--KHLL-UTILITIES-1997-0004)

- On November 15, 1995, a firefighter at the Paducah Gaseous Diffusion Plant observed a spark and felt a sensation in his arm when his wrench contacted an exposed 120-volt heat-tracing conductor. The heat-tracing was plugged into a ground fault circuit interrupter that tripped during the incident. (ORPS Report ORO--LMES-PGDPENVRES-1995-0002)

- On September 19, 1995, inspectors at Rocky Flats discovered exposed, damaged 208-volt heat-trace wires in a weir box. Maintenance personnel damaged the heat-trace wires while cutting two holes to run piping through the weir box. (ORPS Report RFO--KHLL-ENVOPS-1995-0003)

- On April 2, 1993, a pipefitter at the Savannah River Site observed an electrical arc when his file came in contact with an energized heat-trace wire while he was filing a pipe stub. The heat-trace wire was cut flush with a wall penetration and was not terminated. (ORPS Report SR--WSRC-ITP-1993-0006)

- On October 21, 1992, a rigger at the Hanford Site received an electrical shock when a section of scaffolding contacted a deteriorated 110-volt heat-trace wire on a drainpipe that was not insulated. (ORPS Report RL--WHC-WHC300EM-1992-0052)

- On February 1, 1991, a health physics technologist at the Hanford Site received an electrical shock when he contacted a damaged heat-trace line while performing a routine smear survey. (ORPS Report RL--WHC-TANKFARM-1991-0103)

These events illustrate the problems that can be encountered while working on or in proximity to energized electrical heat-trace systems. Damaged heat-trace wires can cause fires or result in electrical shock hazards. Although these systems are typically low voltage (110 to 208 volts), they are nonetheless dangerous, and it would be prudent to lock out these circuits until work has been completed. OSHA 1926.416, sub-part K, *Electrical - Safety-Related Work Practices*, states: "No employer shall permit an employee to work in proximity to any part of an electrical power circuit in the course of work, unless the employee is protected against electrical shock by de-energizing the circuit and grounding it or by guarding it effectively by insulation or other means."

The Los Alamos event also points out the importance of providing immediate notification to emergency response personnel. Although the facility coordinator's attempts to locate and de-energize the heat-tracing were appropriate, delays in making emergency notification could have placed personnel and the facility in jeopardy if the fire could not have been controlled or extinguished. De-energizing the heat tracing was delayed because of confusing labeling of the heat-trace circuit in the electrical panel. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVIII, "Equipment and Piping Labeling," states a good labeling program

will help reduce operator and maintenance errors resulting from incorrect identification of equipment. Labels should be consistent with the information contained in facility documentation and easily understood.

KEYWORDS: electrical shock, fire, insulation, labeling, lockout and tagout, pipe, short circuit

FUNCTIONAL AREAS: Construction, Electrical Maintenance, Mechanical Maintenance

5. WASTE WATER SPILL AT THE IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY

On March 17, 1998, at the Idaho National Engineering and Environmental Laboratory Test Reactor Area, an operator inadequately secured one end of a hose that went to a drain pit sump, resulting in a spill of a reportable quantity of waste water. The Idaho Department of Environmental Quality concluded that the spill was a reportable quantity based on historical waste water constituents that included small amounts of spent halogenated and non-halogenated solvents and hydrofluoric acid. Investigators believe that pulsations from an air-diaphragm pump caused the hose to come out of the sump and spill approximately 15 gallons of water onto a concrete pad. Operators used absorbent materials to clean up most of the spill. Radiological control technicians did not detect any radiological contamination in the spilled water. Operators estimated that approximately 1 gallon of water was absorbed into the soil at the edge of the concrete pad, but no waste water from the spill flowed outside of the radiological buffer area. A lack of detail in procedures led to a relatively minor environmental release that triggered extensive reporting requirements. (ORPS Report ID--LITC-ATR-1998-0004)

Investigators reported that the operator used an approved procedure to transfer the waste water. The procedure required the operator to connect a 3-inch hose between the pump and the drain pit sump. The operator connected the hose to the pump using the cam-lock fittings installed on the hose and pump. The procedure did not specify how to connect the hose to the drain pit sump, so the operator used tape to secure it. The tape did not secure the hose sufficiently to keep it from coming out of the sump during pumping operations.

Investigators believe that the pulsations from the air-diaphragm pump contributed to the failure. Investigators determined that the procedures did not refer to a specially designed piping adapter to secure the hose to the sump pit drain. The adapter is a piece of straight pipe that has a cam-lock device on one end to positively engage with the 3-inch hose. The other end of the pipe fits securely into the drain pit sump opening. During a critique of the event, investigators determined that pre-job briefers were aware of the adapter, but no one told the operator to use the adapter in the pre-job briefing. Planned corrective actions include modifying the procedures to require operators to use the specially designed adapter.

NFS has reported on occurrences involving inadequate procedures in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-49 reported that an operator at the Idaho National Engineering and Environmental Laboratory Advanced Test Reactor was sprayed with approximately 50 milliliters of sulfuric acid foam while disconnecting an air hose to an air sparge line of an empty, 8,000-gallon, bulk-acid storage tank. Procedures did not include the sparge line air hose connection inside the boundaries of the

work zone. If the boundaries had been properly selected, the operator would have been required to wear personal protective equipment. (ORPS Report ID--LITC-ATR-1997-0025)

- Weekly Summary 96-52 reported that a control room operator at the Savannah River Reactor Materials Facility left the controls of an operating pump unattended while filling a melter feed tank, and low-level radioactive sludge overflowed onto a concrete slab. The operator left the control room with the pump operating in manual and the control valve open. After verifying the level and returning to the control room, he was distracted, and did not close the valve until an operator in an off-gas area reported the tank was overflowing. The operating procedure for the system allowed operating the system in either the manual or automatic modes. However, the procedure did not provide any precautions warning that the interlocks would be disabled when the pump is operated in the manual mode. (ORPS Report SR--WSRC-RMAT-1996-0009)

- In Weekly Summary 92-31, operator errors and procedure deficiencies resulted in a tank overflow at the Savannah River H-Canyon facility. The controlling procedure used did not contain explicit steps for operating the tank fill valve. Consequently, an operator forgot to close the fill valve, and the tank overflowed into the drain header. The corrective action required a procedure revision to identify tank and valve configurations. (ORPS Report SR--WSRC-HCAN-1992-0091)

This event underscores the importance of well-written procedures. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," states that procedures are a key factor affecting operator performance. Appropriate attention should be given to writing, reviewing, and monitoring operations procedures to ensure the content is technically correct and the wording and format are clear and concise. Operations procedures should be sufficiently detailed to perform the required functions without direct supervision. Operators should not be expected to compensate for shortcomings in procedures such as poor format or confusing, inaccurate, or incomplete information. As stated in the Order, "procedures should be written in such a way that they can be easily used without making mistakes." DOE-STD 1029-92, *Writers Guide For Technical Procedures*, provides guidance to assist procedure writers in producing accurate, complete, and usable procedures that promote safe and efficient operations.

KEYWORDS: operating procedures

FUNCTIONAL AREAS: Procedures

OEAF FOLLOW-UP ACTIVITY

1. UPDATE ON OMEGA SPRINKLER HEADS

Weekly Summary 97-49, Article 2, reported that a fire system cognizant engineer at the Hanford Site Plutonium Finishing Plant notified a building emergency director that three of seven Omega flow control sprinklers removed from the facility for testing by the manufacturer failed during testing. The manufacturer, Central Sprinkler Corporation, notified customers of a potential defect with their Omega series sprinklers and asked them to submit samples for testing. Underwriters

Laboratory recommends that these sprinklers flow water at a minimum pressure of 7 psig. Central Sprinkler Corporation determined that non-activation of the Omega sprinklers at low pressures is caused by reactions between an internal o-ring and residual hydrocarbons in the sprinkler system water from cutting oils or from improper use of stop-leak products. In June of 1996, Central Sprinkler changed the o-ring material from ethylene propylene diene monomer to silicone, eliminating the hydrocarbon reaction problem. The vendor will replaced all of the approximately 780 Omega sprinklers at the Plutonium Finishing Plant. (ORPS Report RL--PHMC-PFP-1997-0050)

On March 4, 1998, the U.S. Consumer Product Safety Commission announced that its staff filed an administrative complaint against Central Sprinkler Corporation, alleging that Central's "Omega" series fire sprinklers present a substantial product hazard. The complaint seeks a nationwide recall of the approximately 10 million Omega fire sprinklers that Central has manufactured since 1982. Central Sprinkler said it strongly disagreed with the Commission's conclusions and intended to defend its product.

In its complaint, the Consumer Product Safety Commission staff alleges that these sprinklers are defective and are likely to fail in a fire situation. The sprinklers may not properly activate in the event of a fire, thus exposing the public to bodily injury or death. The Commission is aware of six fires in which Omega fire sprinklers reportedly failed to operate. In one of these instances, the fire caused more than $3 million in property damage. The Commission staff filed the complaint after discussions with the company failed to result in a voluntary recall and replacement plan acceptable to the Commission.

On August 13, 1997, Underwriters Laboratories issued a press release strongly urging property owners whose buildings are equipped with Omega sprinklers to immediately submit samples of the sprinklers to Underwriters Laboratory or Central Sprinkler Corporation for operational testing. Although other manufacturers make similar-looking models, Omega sprinkler models are generally identified by their three circular heat collection fins.

Underwriters Laboratory established a toll-free number, (800) 758-1794, to help property owners and managers arrange for samples of Omega sprinklers to be sent to them for testing. Sprinkler samples may also be submitted to the manufacturer for testing to the attention of Andy Post, Consumer Service Coordinator, Central Sprinkler Corporation, 451 North Cannon Avenue, Lansdale, PA 19446. Mr. Post can also be contacted by phone at (215) 362-0700 or (800) 523-6512. Additional information about the Consumer Product Safety Commission complaint can be obtained by calling the Commission at (800) 638-2772.

KEYWORDS: fire suppression, inspection

FUNCTIONAL AREAS: Fire Protection